JAWORSKI
GEOTECH, INC.

COPY

August 11,1992

Mr. John Bruno, Bridgewater Town Engineer
c/o Bruno Associates
Post Office Box 387
Woodstock, VT 05091

RE: SUBSURFACE EXPLORATION
BRIDGEWATER ELEMENTARY SCHOOLS
BRIDGEWATER, VERMONT PROJECT NO. V91232

Dear Mr. Bruno:

The following is our summary report concerning an evaluation of subsurface conditions at the above referenced site (Photoplate 1). The project site is located in the Town of Bridgewater, Windsor County, Vermont. The "Site Location Plan" is provided as Figure 1. The purpose of this evaluation was to assess the level of volatile organic compounds (VOCs) and total petroleum hydrocarbons (TPHs) in the groundwater at the site.

The initial phase of this evaluation was accomplished in December 1991/January 1992. The results of that work were presented in our report of March 2, 1992, submitted to Mr. David Beilman, Woodstock, Vermont. At that time, Mr. Beilman was directing the evaluation. The information contained within the March 2 report, including site description, soil borings and groundwater measurements have not been duplicated in this report. However, for your convenience a copy of the report is attached.

SUBSURFACE EXPLORATION AND CONDITIONS ENCOUNTERED

The subsurface exploration program included the preparation of a groundwater contour plan from measurements on the three (3) existing wells, and the installation of four (4) additional monitoring wells downgradient from the oil release.

On May 28, 1992, Jaworski Geotech, Inc. (JGI) and T&M Engineering, Lebanon, New Hampshire, visited the site for the purpose of obtaining locations and elevations, by survey, of the 3 existing monitoring wells (MW-1, MW-2, MW-3). Groundwater measurements were obtained by JGI and the direction of groundwater flow evaluated. Based on these observations locations for an additional 4 monitoring wells, downgradient from the UST were selected.

Monitoring well locations are presented in Figure 2.

Four monitoring wells (MW-4,MW-5,MW-6,MW-7) were installed on June 19,1992. The monitoring wells were installed by Ottauquechee Well Drilling, Woodstock, Vermont. Mr. George Spear, Owner, was the foreman of the drill rig. A summary of well construction and monitoring well installation follows.

A borehole was advanced using an Air Rotary Drill equipped with a 8½ inch roller bit (Photoplate 2). Previous attempts to install monitoring wells with a hollow stem auger were unsuccessful due to an underlying boulder field at the site. The borehole was advanced until a sufficient depth of water (minimum 5 feet) was achieved in the well. The wells were constructed from 2 inch Schedule 40 PVC well screen and riser pipe. The protective casing was a 7 inch steel street box. A sand filter layer was poured around the well screen and a Bentonite seal was installed around the riser pipe. In general material excavated from the borehole was used to backfill the hole above this seal. A concrete surface seal was poured around the protective casing. The Monitoring Well Logs are attached to this report.

Soils were classified as the boring was advanced. In general the soils were composed of medium to fine sand and gravel layered between boulders down to a depth of 18 to 25 feet where a gray silt layer was encountered. Samples of soil were collected and VOC levels measured in the field using an HNU photoionization detector (PID) and "headspace" method. A PID reading of 50 ppm was recorded in a composite soil sample from 14-20 feet at MW-6. All other soil samples contained low levels of VOCs. The Drilling Logs are attached to this report.

The soil removed during the advancement of the test boring for MW-6 (approximately 0.25cu.yds.) was polyencapsulated on site. The soil will be disposed of in accordance with the State of Vermont Interim Soil Guideline Levels and Treatment Options.

GROUNDWATER SAMPLING AND ANALYSIS

On June 24 and 26, 1992, JGI visited the site for the purpose of locating the recently installed wells, by survey, and obtaining groundwater samples from all monitoring wells. Observations such as depth to water, pH and specific conductance were made. A summary of the field groundwater observations are attached.

Groundwater measurements and samples were collected employing the following protocol. Field instruments used to measure conductivity and temperature were cleaned with methanol and distilled water rinses between wells to reduce the potential of cross

contamination. The temperature and conductivity at the top and bottom of the groundwater in the monitoring well were measured with a YSI (Yellow Springs Instruments) meter. Following this measurement the wells were purged by removal of three to five times the volume of the well with a disposable polyethylene bailer. A dedicated bailer was used for each well. After purging, the pH was measured with a field pH meter calibrated with pH 7.0 buffer. Samples were collected in glass containers and preserved with the appropriate acid. The samples were packed in ice for transport to the laboratory. The samples were submitted to Eastern Analytical Laboratories (EAL), Concord, New Hampshire for VOC (EPA Method 8020) and TPH (EPA Method 418.1) analysis.

In addition to the groundwater samples collected from the seven (7) monitoring wells, three (3) potable water wells were sampled. The shallow water well (assumed) supplying the school and town offices was sampled from a tap in the school basement. The nearest downgradient potable water wells were identified and sampled, an artesian well on the Steve and Bonnie Carr (PW-2) property, Main Street, Bridgewater (P. O. Box 143, Bridgewater, VT) and a shallow well on the Marion Cassano (PW-3) property, Route 4, Bridgewater (P. O. Box 20, Bridgewater, VT). The private wells are located beyond the eastern end of the soccer field.

The results of the chemical analysis indicated the presence of 35 parts per million (ppm) TPHs in the monitoring well (MW-6) located nearest to the underground storage tank (UST) (See Figure 2 & Photoplate 1). Dissolved TPHs were at non-detectable levels in all other water samples submitted for analysis. The laboratory results indicated that no VOCs, analyzed for, were present above the detection limit. Copies of the laboratory reports are attached.

EVALUATION AND RECOMMENDATIONS

Based on the results of this study we have completed an evaluation of the site relative to the TPH contamination. Indications are that the plume of contamination is relatively immobile in the soil adjacent to the site of release. Potable water has not been impacted by the contamination at this time.

It is recommended that monitoring of the groundwater and the school potable water well be continued on a quarterly basis until such time as the contaminated soil can be excavated and disposed of off-site. Further monitoring may continue on a semi-annual basis following the soil removal so that decreased contaminant concentrations may be observed.

Since the site is an elementary school with limited area, forsafety and security considerations, on-site remediation of the soils is not recommended. It is further recommended that the excavation and removal of the soil be accomplished during a time when school is not in session. The measured levels of TPH would indicate that this material could be disposed of at a certified landfill, in AOT Road Projects or by asphalt batching.

We trust the contents of this report meets with your approval. Should you have any questions or require further information please do not hesitate to contact our office.

Very truly yours,

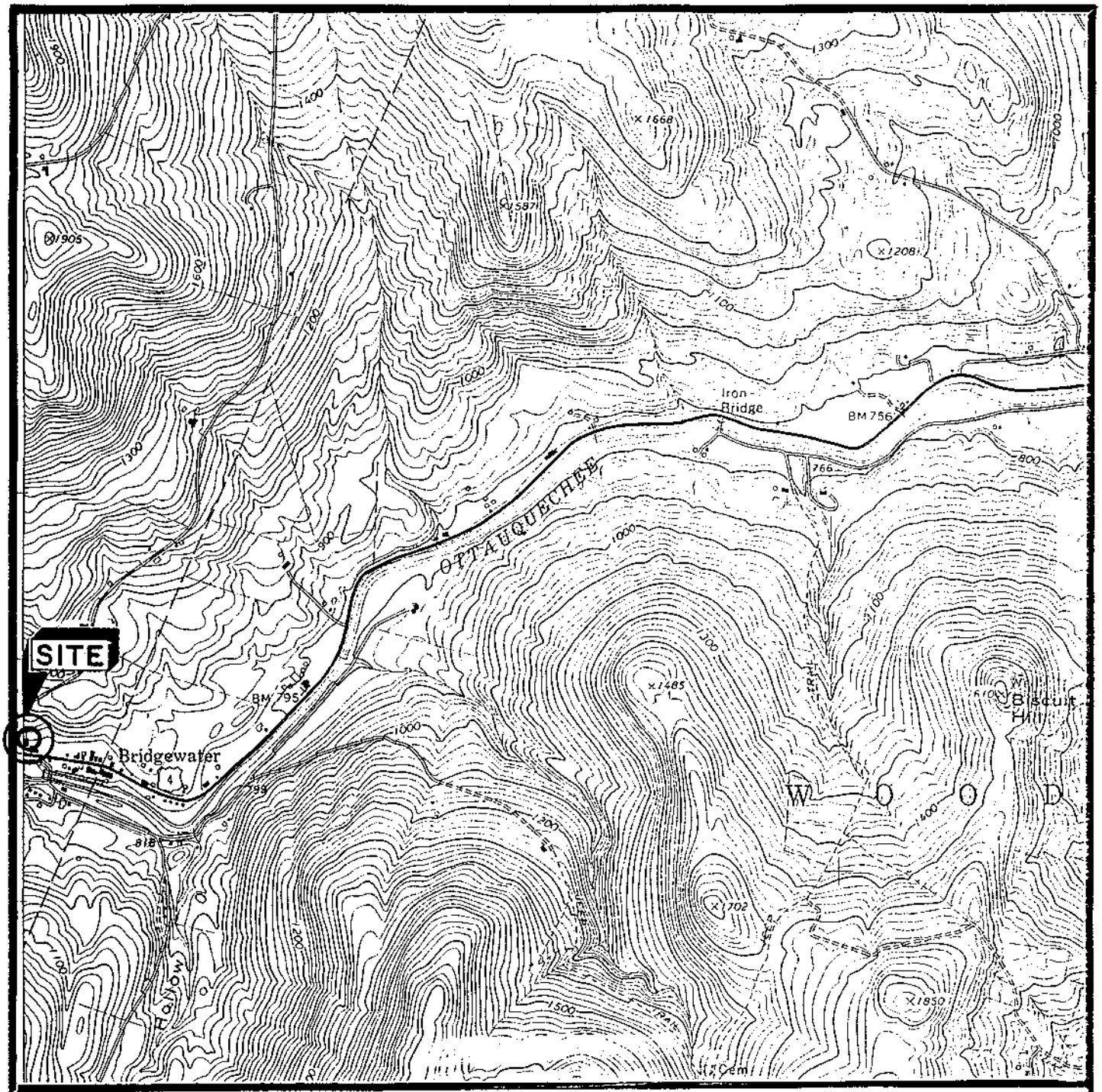
JAWORSKI GEOTECH, INC.

Cliff Lyons

Cliff Lyons

Attachments

cc: Cindy Woods
David Beilman



SCALE 1:24000

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

PROJECT: Bridgewater School
Bridgewater, VT

PROJECT NO: V91232

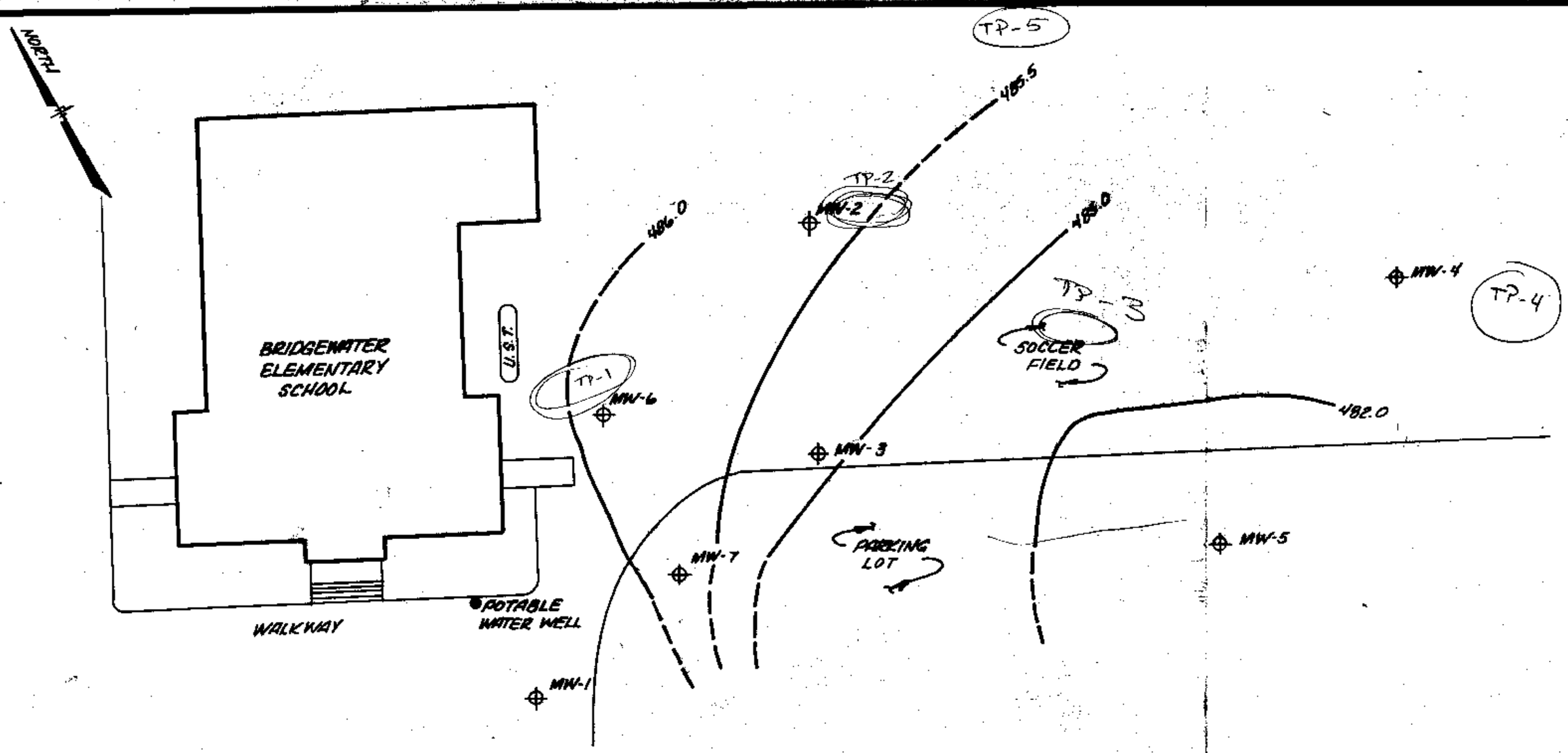
DATE: August, 1992

SOURCE: South Woodstock, VT
USGS Quad Rev. 1983

FIGURE 1

LOCATION PLAN

JGI
JAWORSKI
GEOTECH, INC.



JGI JAWORSKI GEOTECH, INC.

PREPARED FOR: DAVID BEILMAN
BEILMAN ARCHITECTURE
P.O. BOX 610
WOODSTOCK, VT 05091

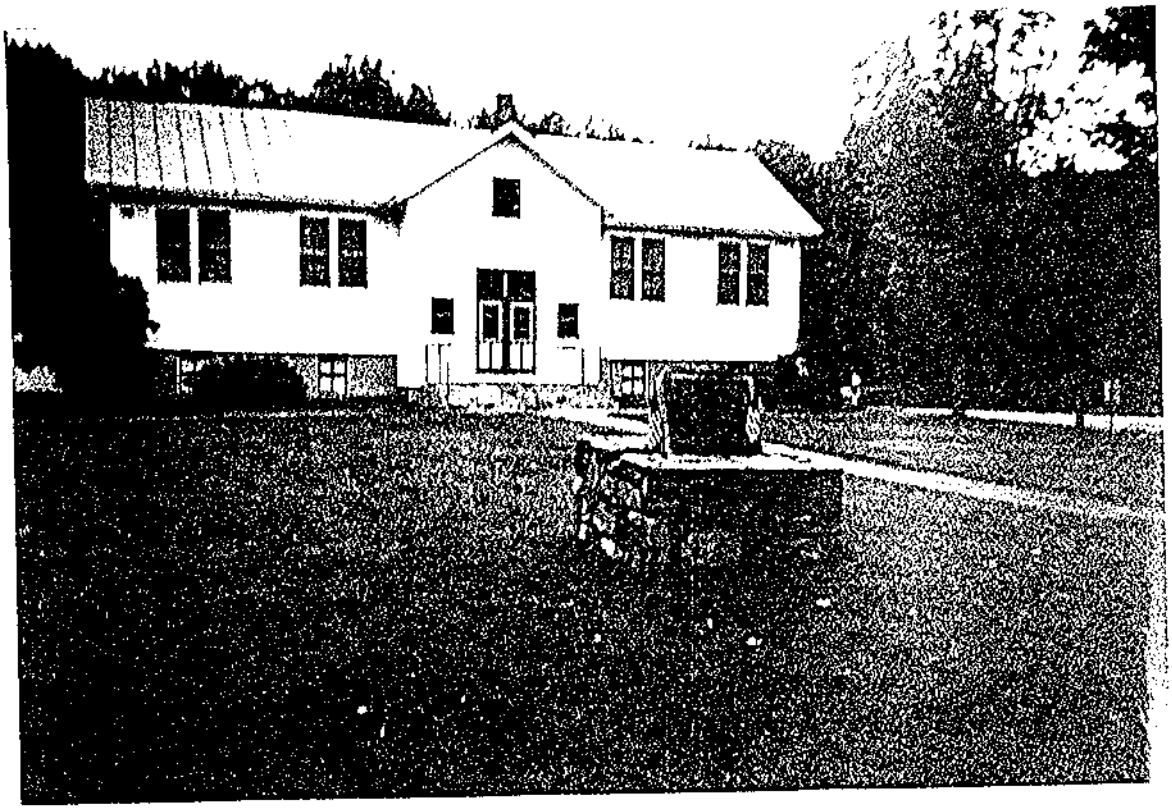
DATE: AUGUST, 1992
SCALE: 1" = 20'
PROJECT NO. V91232

BRIDGEWATER SCHOOL

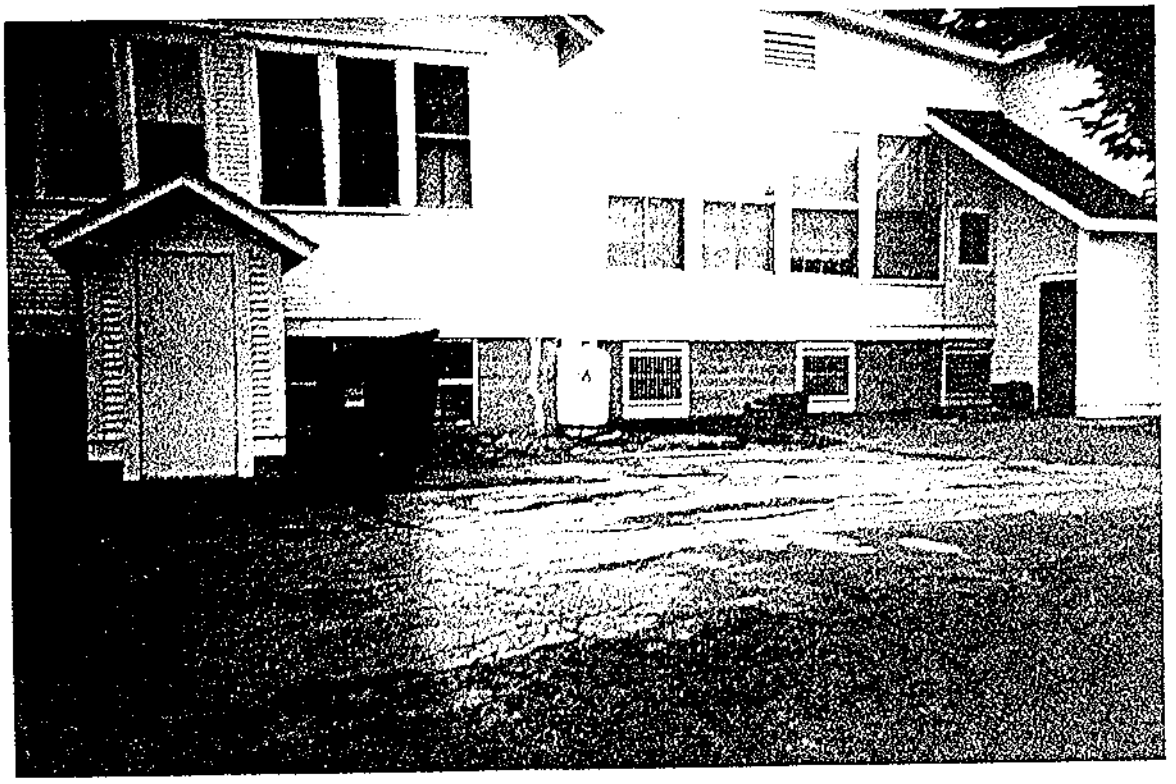
BRIDGEWATER, VERMONT

FIGURE 2

SUBSURFACE EXPLORATION LOCATION PLAN

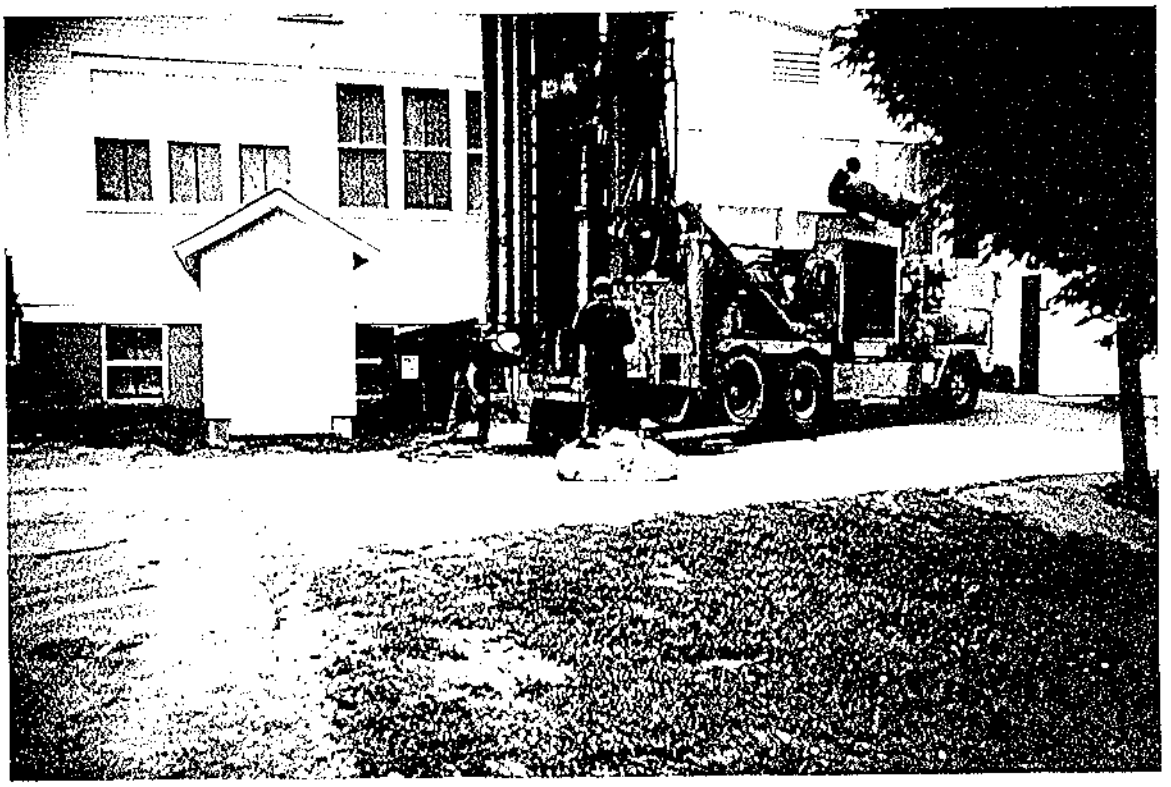


Bridgewater Elementary School



Eastern Side of School, the UST is located in front of the window, to the right propane tank.

PHOTOPLATE 1



Air Rotary Drill - DRILLING MONITORING WELL 6 (MW-6)

PHOTO PLATE 2

DRILLING LOG

Project: Bridgewater School
Bridgewater, Vermont

Sheet: 1 of 2
JGI Representative: Cliff Lyons

Date: June 19, 1992

Weather: Cloudy, Occasional Showers

Drilling Contractor: Ottauquechee Well Drilling
Equipment Operator: Mr. George Spear, Owner
Equipment: Ingersol-Rand, T-4 Air Rotary Drill
8½ inch Roller Bit

Location: Monitoring Well 4 (MW-4)

Depth (feet)	Sample (No.)	Soil Description	HNU (ppm)
0-2	S-1	Loam, brown, fine to medium sand with little gravel	<0.1
2-5		Boulders	
5-8	S-2	Hard packed, gray/brown, fine sand and gravel	<0.1
8-9½		Boulder	
9½-10		Hard packed, fine sand and gravel	1.5
10-11½		Boulder	
11½-17	S-3	Hard packed, gravel with fine sand	1.5
17-18		Silts, fine, sand some gravel moist	
18-23	S-4	Gray, "dense" silt	1.5
23		Drilling Terminated	

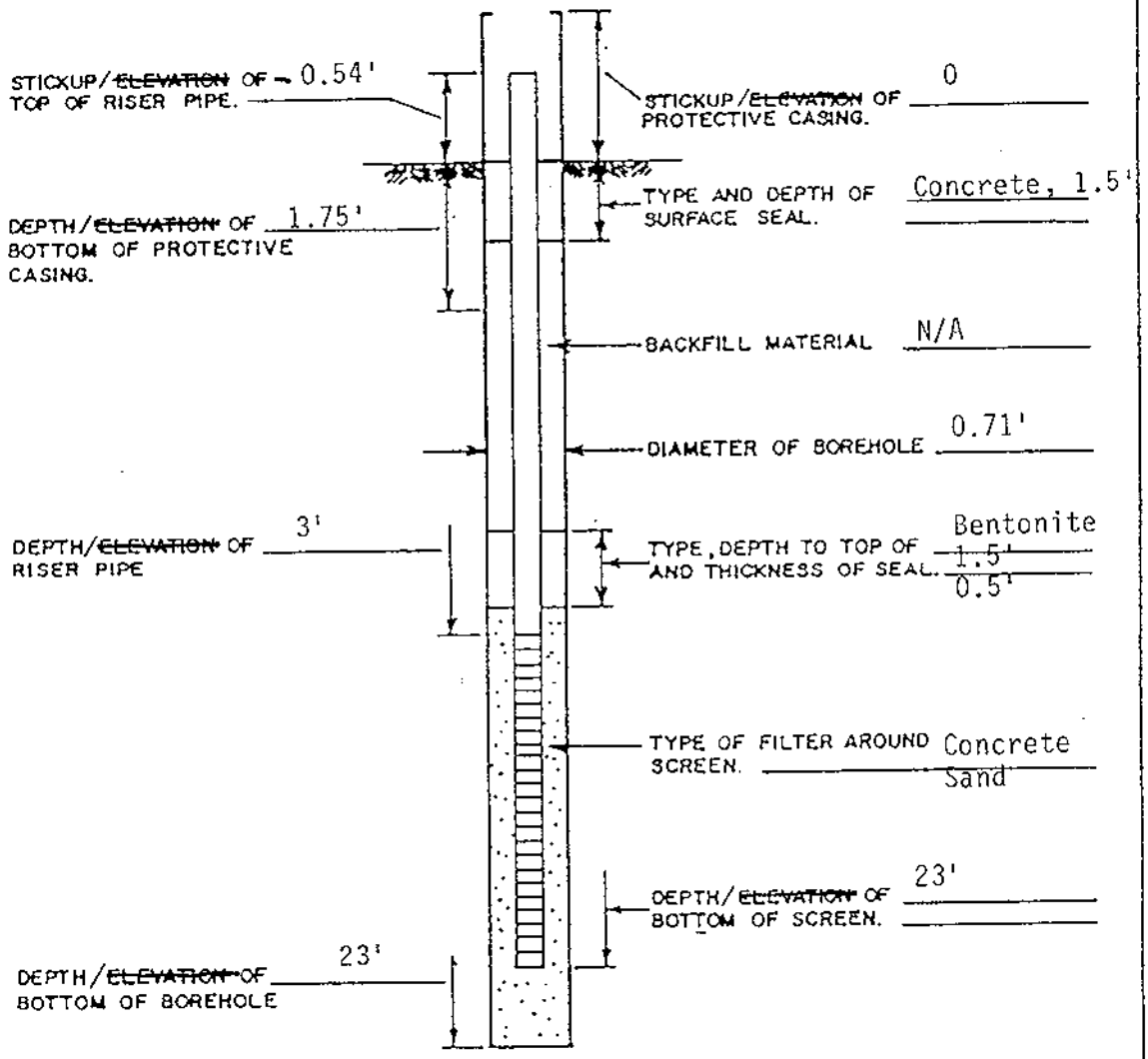
Notes: Samples are composite samples.
HNU (ppm) done by headspace method.

Proportions Used: trace (0-10%), little (10-20%), some (20-35%), and (35-60%)

Depth of Groundwater: 10.7 feet from casing after 4 hours.

MONITORING WELL LOG

Project: Bridgewater School Bridgewater, VT Project No.: V91232 Date Start: June 19, 1992 Date End: June 19, 1992	Drilling Co.: Ottaquechee Well Drilling Forman: George Spear J.G.L Representative: Cliff Lyons	Sheet 2 of 2 Boring No.: Well No: MW-4 Surface Elev.:



WELL MATERIALS

	TYPE	DIAMETER	LENGTH
PROTECTIVE CASING	Steel	0.58'	2.17'
RISER PIPE	PVC Sch 40	2"	2.46'
WELL SCREEN	PVC Sch 40	2"	20'

JGI JAWORSKI GEOTECH, INC.

DRILLING LOG

Project: Bridgewater School
Bridgewater, Vermont

Sheet: 1 of 2
JGI Representative: Cliff Lyons

Date: June 19, 1992

Weather: Cloudy, Occasional Showers

Drilling Contractor: Ottauquechee Well Drilling
Equipment Operator: Mr. George Spear, Owner
Equipment: Ingersol-Rand, T-4 Air Rotary Drill
8½ inch Roller Bit

Location: Monitoring Well 5 (MW-5)

Depth (feet)	Sample (No.)	Soil Description	HNU (ppm)
0-6½	S-1	Brown, fine to medium sand, some gravel	<0.1
6½-9		Gray, fine sand and gravel, some silt	
9-11	S-2	Medium sand and gravel	1.0
11-12½		Boulder	
12½-14		Dark brown, sand and gravel	<0.1
14-17	S-3	Gray, fine sand, some gravel	1.5
17-19½		Dark brown, fine sand and gravel	
19½-21	S-4	Dark brown, moist fine sand and gravel	
21-22		Gray, moist silt	1.5
22		Drilling Terminated	

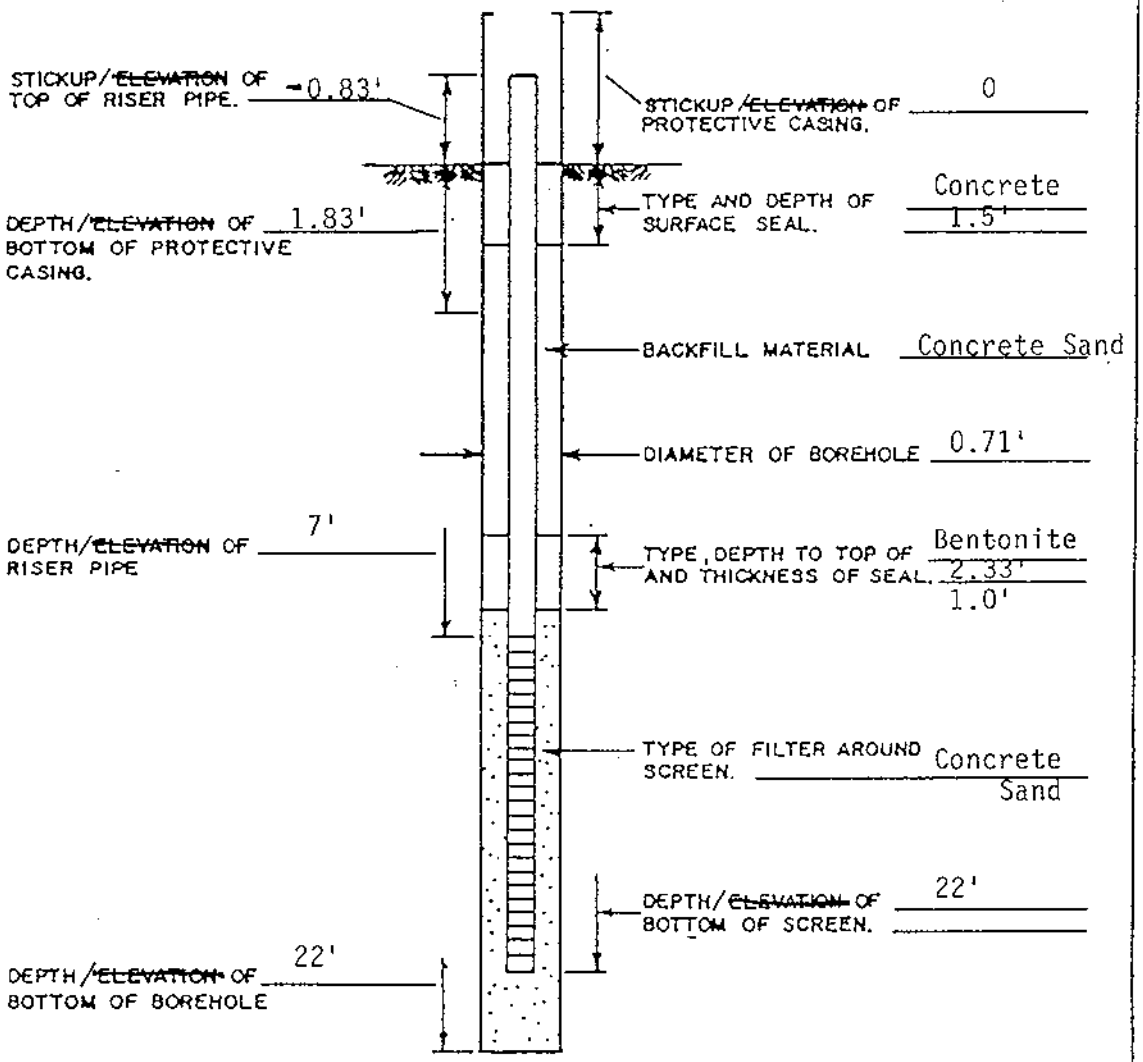
Notes: Samples are composite samples.
HNU (ppm) done by headspace method.

Proportions Used: trace (0-10%), little (10-20%), some (20-35%), and (35-60%)

Depth of Groundwater: 16.1 feet from casing after 3 hours.

MONITORING WELL LOG

Project: Bridgewater School Bridgewater, VT Project No.: V91232 Date Start: June 19, 1992 Date End: June 19, 1992	Drilling Co.: Ottaquechee Well Drilling Forman: George Spear J.G.I. Representative: Cliff Lyons	Sheet 2 of 2 Boring No.: Well No: MW-5 Surface Elev.:



WELL MATERIALS

	TYPE	DIAMETER	LENGTH
PROTECTIVE CASING	Steel	0.58'	1.83'
RISER PIPE	PVC Sch 40	2"	6.17'
WELL SCREEN	PVC Sch 40	2"	15'

JGI JAWORSKI GEOTECH, INC.

DRILLING LOG

Project: Bridgewater School
Bridgewater, Vermont

Sheet: 1 of 2
JGI Representative: Cliff Lyons

Date: June 19, 1992

Weather: Cloudy, Occasional Showers

Drilling Contractor: Ottauquechee Well Drilling
Equipment Operator: Mr. George Spear, Owner
Equipment: Ingersol-Rand, T-4 Air Rotary Drill
8½ inch Roller Bit

Location: Monitoring Well 6 (MW-6)

Depth (feet)	Sample (No.)	Soil Description	HNU (ppm)
0-10½	S-1	Brown, very fine to medium sand some gravel	5.0
10½-12		light gray, fine to medium sand and gravel	
12-13		Light brown, very fine to fine sand	
13-14		Boulder	
14-20	S-2	Brown, moist, fine sand and gravel	50.0
20-23		Gray, moist, silt	
23		Drilling Terminated	

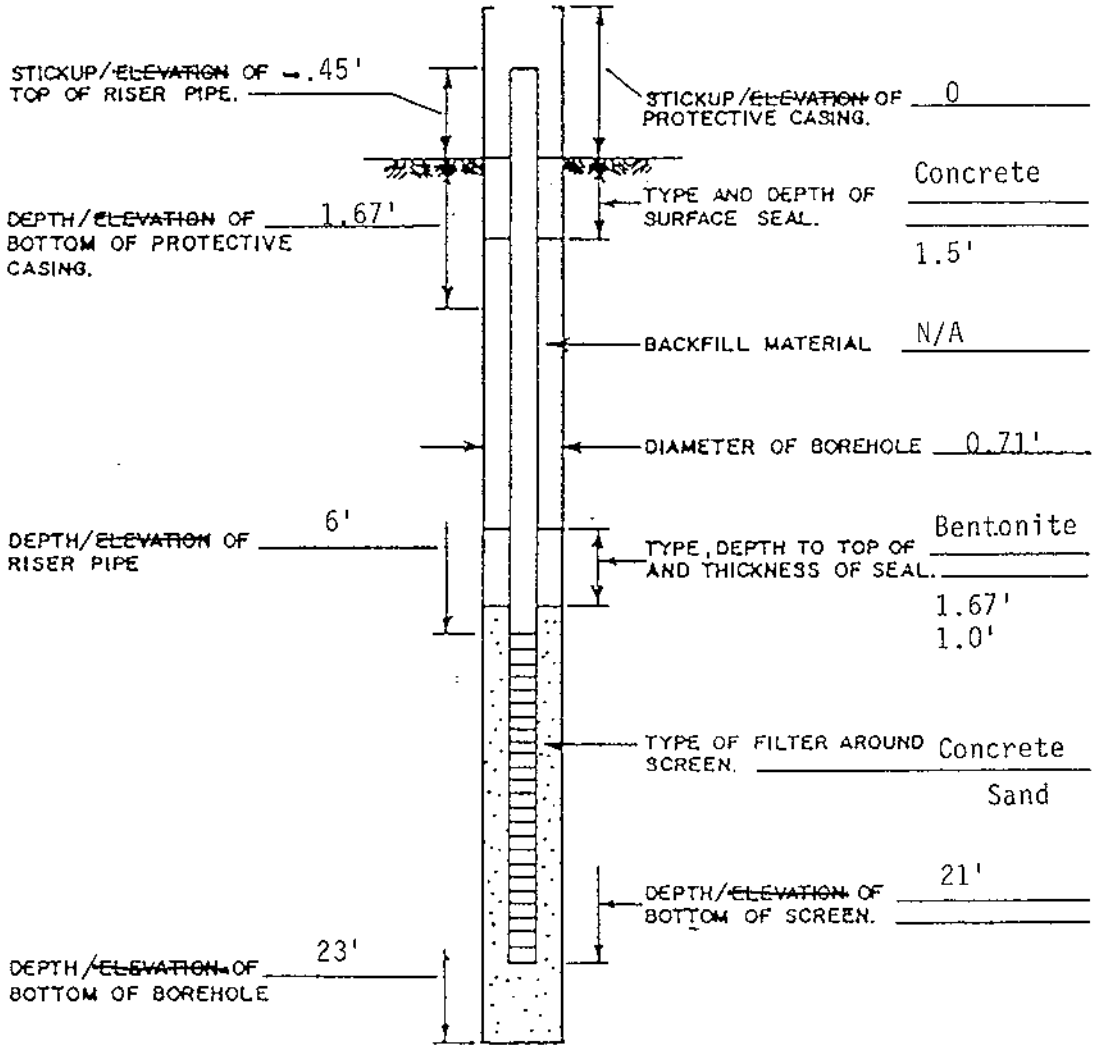
Notes: Samples are composite samples.
HNU (ppm) done by headspace method.
Contaminated soil from drilling was stockpiled on site.

Proportions Used: trace (0-10%), little (10-20%), some (20-35%), and (35-60%)

Depth of Groundwater: 12.5 feet from casing after 1 hour.

MONITORING WELL LOG

Project: Bridgewater School Bridgewater, VT Project No.: V91232 Date Start: June 19, 1992 Date End: June 19, 1992	Drilling Co.: Ottaquechee Well Drilling Forman: George Spear J.G.L Representative: Cliff Lyons	Sheet 2 of 2 Boring No.: Well No: MW-6 Surface Elev.:



WELL MATERIALS

	TYPE	DIAMETER	LENGTH
PROTECTIVE CASING	Steel	0.58'	1.67'
RISER PIPE	PVC Sch 40	2"	5.55'
WELL SCREEN	PVC Sch 40	2"	15'

JGI JAWORSKI GEOTECH, INC.

DRILLING LOG

Project: Bridgewater School
Bridgewater, Vermont

Sheet: 1 of 2
JGI Representative: Cliff Lyons

Date: June 19, 1992

Weather: Cloudy, Occasional Showers

Drilling Contractor: Ottauquechee Well Drilling
Equipment Operator: Mr. George Spear, Owner
Equipment: Ingersol-Rand, T-4 Air Rotary Drill
8½ inch Roller Bit

Location: Monitoring Well 7 (MW-7)

Depth (feet)	Sample (No.)	Soil Description	HNU (ppm)
0-5	S-1	Dark brown, sand and gravel	<0.1
5-8		Gray, very fine to medium sand	
8-10	S-2	Brown, very fine sand	1.0
10-12		Boulder	
12-14		Dark brown, sand and gravel	
14-17	S-3	Gray/brown, sand and gravel	3.0
17-21	S-4	Brown, very fine sand and gravel	2.0
22-26		Dark brown, moist, gravel, some sand	
26-27	S-5	Gray, moist, silt	2.0

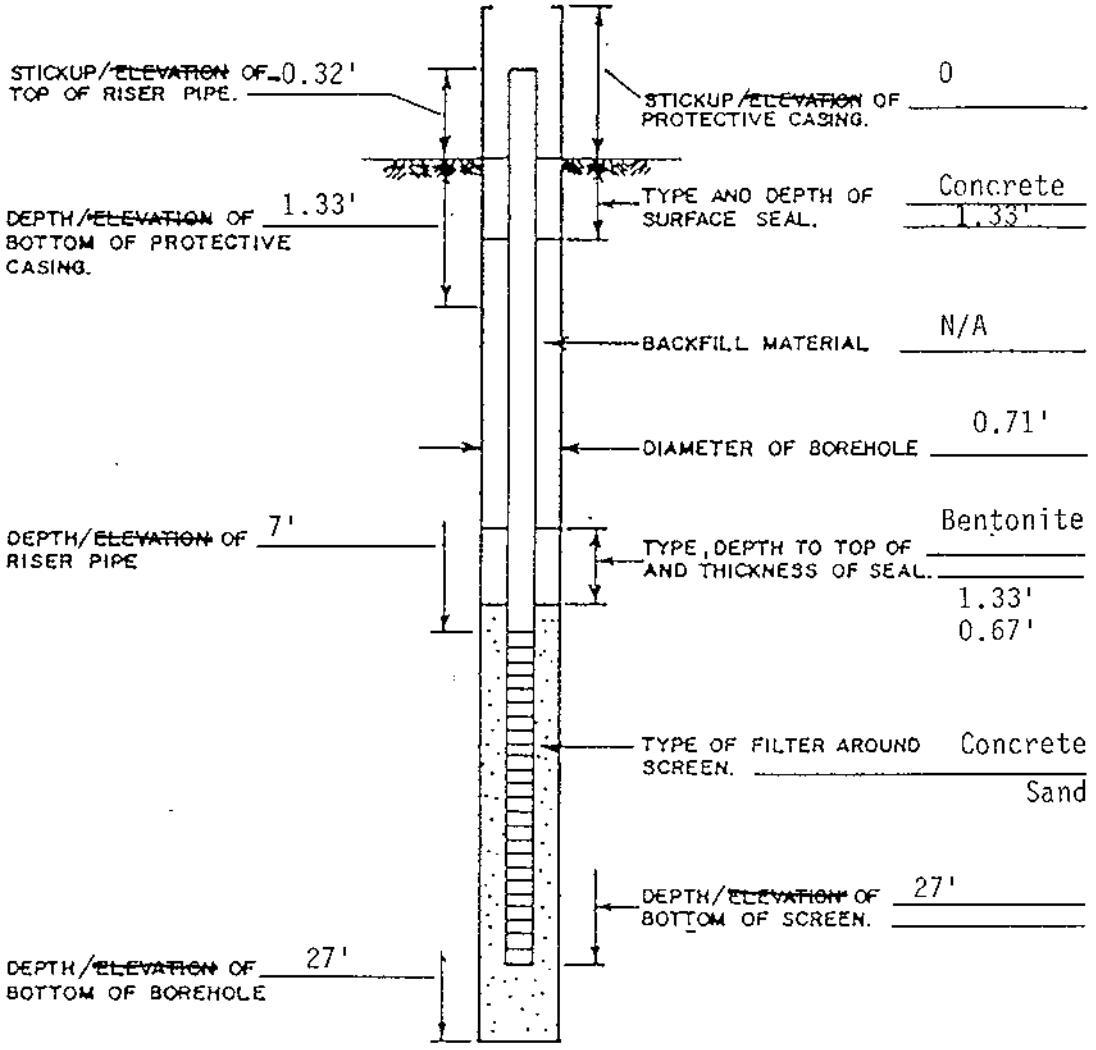
Notes: Samples are composite samples.
HNU (ppm) done by headspace method.

Proportions Used: trace (0-10%), little (10-20%), some (20-35%), and (35-60%)

Depth of Groundwater: 11.7 feet from casing after ½ hour.

MONITORING WELL LOG

Project: Bridgewater School Bridgewater, VT Project No.: V91232 Date Start: June 19, 1992 Date End: June 19, 1992	Drilling Co.: Ottaquechee Well Drilling Forman: George Spear J.G.I. Representative: Cliff Lyons	Sheet 2 of 2 Boring No.: Well No: MW-7 Surface Elev.:



WELL MATERIALS

	TYPE	DIAMETER	LENGTH
PROTECTIVE CASING	Steel	0.58'	1.33'
RISER PIPE	PVC Sch 40	2"	6.68'
WELL SCREEN	PVC Sch 40	2"	20'

JGI JAWORSKI GEOTECH, INC.

MONITORING WELL
FIELD GROUNDWATER OBSERVATIONS

PROJECT Bridgewater School CLIENT Bridgewater School

PROJECT NO. V91232 WEATHER Cloudy, 60's, Rain

DATE June 24, 1992 INSTRUMENT(S) YSI, pH meter

TECHNICIAN Chris Ellis

WELL NO.	SURFACE ELEV.	WELL ELEV.	WATER TABLE ELEV.	DEPTH OF WELL	DEPTH TO WATER	WATER COLUMN THICKNESS	TEMP. (°C)	pH	SPECIFIC CONDUCTANCE TOP	SPECIFIC CONDUCTANCE BOTTOM
PW-1	Potable water	well	Sink (basement) cold water tap							
MW-1				25.40	13.52	11.88	8.4	7.03	0.60	0.78
MW-2	slight smell of oil (no sheen)		oil	26.30	14.65	11.65	11.1	6.72	0.69	0.44
MW-3				28.12	13.47	14.65	10.2	6.71	0.36	0.40
MW-4				21.44	10.98	10.46	8.8	6.48	0.66	0.69
MW-5				20.44	16.31	4.13	10.4	6.21	0.41	0.37
MW-6	smell		and sheen of oil	19.96	13.07	6.89	10.2	6.43	0.43	0.28
MW-7				25.40	12.19	13.21	9.8	6.45	0.43	0.51

LABORATORY REPORT

Eastern Analytical, Inc. ID#: 4157 JGI

Client: Jaworski Geotech Inc.
Client Designation: **V91232/Bridgewater School**

Sample Qty/Type: 8 aqueous
Date Received: June 25, 1992

Hazardous Substance List Volatile Organic Compounds

Sample ID:	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	
Matrix:	Aqueous	Aqueous	Aqueous	Aqueous	Aqueous	Aqueous	
Date of Analysis:	7/1/92	7/1/92	7/1/92	7/1/92	7/1/92	7/1/92	
Units:	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	EPA
Analyst:	WB	WB	WB	WB	WB	WB	Method
Dilution Factor:	1	10	1	1	1	10	
Benzene	< 1	< 10	< 1	< 1	< 1	< 10	8020
Toluene	< 1	< 10	< 1	< 1	< 1	< 10	8020
Ethylbenzene	< 1	< 10	< 1	< 1	< 1	< 10	8020
Total Xylenes	< 1	< 10	< 1	< 1	< 1	< 10	8020
Chlorobenzene	< 1	< 10	< 1	< 1	< 1	< 10	8020
Styrene	< 1	< 10	< 1	< 1	< 1	< 10	8020

Sample ID:	MW-7	PW-1	
Matrix:	Aqueous	Aqueous	
Date of Analysis:	7/1/92	7/1/92	
Units:	µg/L	µg/L	EPA
Analyst:	WB	WB	Method
Dilution Factor:			
Benzene	< 1	< 1	8020
Toluene	< 1	< 1	8020
Ethylbenzene	< 1	< 1	8020
Total Xylenes	< 1	< 1	8020
Chlorobenzene	< 1	< 1	8020
Styrene	< 1	< 1	8020

Approved By: Timothy Schaper, Organics Supervisor Timothy D. Schaper

LABORATORY REPORT

Eastern Analytical, Inc. ID#: 4157 JGI

Client: Jaworski Geotech Inc.
Client Designation: **V91232/Bridgewater School**

Sample Qty/Type: 8 aqueous
Date Received: June 25, 1992

Organics

Sample ID: / **Matrix:**	MW-1 Aqueous	MW-2 Aqueous	MW-3 Aqueous	MW-4 Aqueous	Date of Analysis	Analyst	EPA Method
Organics: (mg/L)							
Total Petroleum Hydrocarbons	< 5	< 5	< 5	< 5	7/8/92	LB	418.1

Sample ID: / **Matrix:**	MW-5 Aqueous	MW-6 Aqueous	MW-7 Aqueous	PW-1 Aqueous	Date of Analysis	Analyst	EPA Method
Organics: (mg/L)							
Total Petroleum Hydrocarbons	< 5	**3 5**	< 5	< 5	7/8/92	LB	418.1

Approved by: Lorraine Olashaw, Inorganics Supervisor Lorraine Olashaw

LABORATORY REPORT

Eastern Analytical, Inc. ID#: 4172 JGI

Client: Jaworski Geotech Inc.
Client Designation: **V91232/Bridgewater School**

Sample Qty/Type: 2 aqueous
Date Received: June 26, 1992

Hazardous Substance List Volatile Organic Compounds

Sample ID:	PW-2	PW-3	
Matrix:	Aqueous	Aqueous	
Date of Analysis:	7/6/92	7/6/92	
Units:	µg/L	µg/L	EPA
Analyst:	WB	WB	Method
Benzene	< 1	< 1	8020
Toluene	< 1	< 1	8020
Ethylbenzene	< 1	< 1	8020
Total Xylenes	< 1	< 1	8020
Chlorobenzene	< 1	< 1	8020
Styrene	< 1	< 1	8020

Approved By: Timothy Schaper, Organics Supervisor Timothy D. Schaper

LABORATORY REPORT

Eastern Analytical, Inc. ID#: 4172 JGI

Client: Jaworski Geotech Inc.
Client Designation: **V91232/Bridgewater School**

Sample Qty/Type: 2 aqueous
Date Received: June 26, 1992

Organics

Sample ID: / **Matrix:**	PW-2 Aqueous	PW-3 Aqueous	Date of Analysis	Analyst	EPA Method
Organics: (mg/L)					
Total Petroleum Hydrocarbons	< 5	< 5	7/8/92	LB	418.1

Approved by: Lorraine Olashaw, Inorganics Supervisor Lorraine Olashaw

aworski Geotech, Inc.
inction Marketplace
iite River Junction, VT 05001

CHAIN OF CUSTODY RECORD

PROJ. NO.: V91232 | PROJECT NAME: Bridgewater School

SAMPLERS: (Signature) Christopher W. Ellis

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	VOC METHOD 8020	TPH METHOD 418.1	REMARKS
MW-1	6/24					3	2	1	
MW-1						3	2	1	
MW-4						3	2	1	
MW-5						3	2	1	
MW-7						3	2	1	
MW-6						3	2	1	
MW-2						3	2	1	
MW-3						3	2	1	

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Christopher W. Ellis	6/25/92 9:55	Teresa Dubois			
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	

JGI JAWORSKI GEOTECH, INC.
Cliff Lyons
(802) 295-7800
The Junction Market Place
White River Junction, VT 05001

Jaworski ch, Inc.
Junction tplace
White River Junction, VT 05001

CHAIN OF CUSTODY RECORD

PROJ. NO. VT1232 | PROJECT NAME: BRIDGEWATER SCHOOL

SAMPLERS: (Signature) Christopher W Ellis

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TPH 418.1	VOC 8020	REMARKS
PW-2	6/26/92					3	1	2	
PW-3	6/26/92					3	1	2	

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Christopher W Ellis	6/26/92 2:40				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	
		D. Jaworski	6/26/92 2:40PM		

JGI JAWORSKI
Cliff Lyons
(802) 295-7800